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May 12, 1997

Mr. Peter Cowhey
Chief, International Bureau
Federal Communications Commission
2000 M Street, N.W., Room 830
Washington, D.C. 20554

Re: IB Docket No. 96-220

Dear Mr. Cowhey:

Leo One USA, by counsel, hereby responds to the April 10, 1997 E-SAT "Notice of an Ex Parte Presentation" regarding a meeting held with the staff of the Commission on March 19, 1997.[1] According to this filing, E-SAT acknowledges a potential interference problem to Orbcomm's DCAAS system operations resulting from the E-SAT system design. Leo One USA has reviewed the E-SAT information and does not believe that it provides a basis to allow CDMA and FDMA systems to share Uplinks in the 148.905 - 149.9 MHz band.

E-SAT endeavors to share the Uplink band with both the GE Starsys system and the operations of DCAAS users. It proposes a 1.45 MHz spread signal with a center at 149.175 MHz. Leo One USA proposes to operate its uplink subscriber channels in the band 148.905 - 149.9 using a DCAAS approach to facilitate sharing the spectrum with land mobile users in the band. As discussed herein, E-SAT's proposal has the potential to significantly degrade the performance of the Leo One USA system as well as other DCAAS systems operating in the band. Degradation will be experienced in the form of increasing the noise floor. This will impact the link fading margin and cause interference to DCAAS operations in the band. Also, the E-SAT signals have the potential to mask legitimate land mobile users and spoof the DCAAS detection into false spectrum utilization, locking out Leo One USA's usage.

[1] Leo One USA notes that this ex parte filing was made approximately 21 days after the date prescribed by the Commission's rules for submitting an ex parte notice of the E-SAT meeting with Commission staff.

E-SAT's April 10 Ex Parte presentation has attempted to offer five potential solutions to Orbcomm's "requirements". While Leo One USA cannot assess these approaches with regard to Orbcomm operations there remain significant issues regarding the operation of the Leo One USA DCAAS system. The following responds to the "E-SAT Analysis of DCAAS Users Sharing Options".

- *Solution 1 - Spatial Diversity:* The use of spatial diversity to solve the sharing CDMA/FDMA issues does not seem to offer a significant advantage. The concept of adding an additional plane with half as many satellites does not impact the interference at a Leo One USA satellite. This is because there would presumably be at most only one satellite in-view of the ground terminals at any one time.

- *Solution 2 - Frequency Diversity:* The proposal suggests that E-SAT put its center frequency at 149.175 MHz with a bandwidth of 1.45 MHz. E-SAT states that this leaves 19.5% of Orbcomm's band for which E-SAT's power level is below Orbcomm's stated DCAAS sensitivity even with 81 users. Leo One USA does not consider this an acceptable availability. Reducing the amount of usable spectrum by 80.5% for 30% of each day over CONUS would preclude Leo One USA from finding sufficient clear channels.

  Also, E-SAT's calculations of DCAAS sensitivity are flawed. E-SAT implies 81 concurrent users only increase the noise floor by 9.6 dB. A proper summing of signal powers indicates the noise floor is increased by as much as 19.1 dB. For a Leo One USA satellite with an ISO-Flux antenna, path loss is offset by the antenna gain as a function of elevation angle. Thus, the total noise floor increases directly as the sum of the number of interfering signal powers. Additionally, the composite received CDMA waveform in any 2.5 kHz detection channel resembles a Rayleigh fading waveform. That is, all incident vectors are combining randomly with differing Doppler phase relationships. Rayleigh fading waveforms have more than 5 dB signal enhancements 10% of the time, which exacerbates the detection/false alarm problem.

- *Solution 3 - Transmit Power*: E-SAT has proposed a reduction of its uplink EIRP to 1dBW for its meter terminals.[2] E-SAT indicates that this terminal will have a -3dB antenna gain. This implies that 1 dBW is achieved at the edge of coverage. If so, then the interference could be worse than assumed in Leo One USA's analysis. Nonetheless, for the purposes of this analysis, Leo One USA has used +1 dBW, which may not be the maximum value. E-SAT implies it could reduce the power by

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[2] The EIRP is much reduced from the original E-SAT filing which has an +8.5 dBW EIRP for their omni meter readout terminals. See E-SAT Satellite System Application, File No. 24-SAT-P/LA 95, November 16, 1994 at 3-13 and Figure 5a.

another 3 dB. Leo One USA believes this may not be sufficient to avoid severe loss in margin to Leo One USA's satellite.

- *Solution 4 - Concurrent Users:* E-SAT states that the proposed maximum number of concurrent uplink users is 81, but implies that it would not need to utilize all 81 when it first launches its constellation, rather its business base would grow into some sizable fraction of this set of 81 concurrent users. E-SAT further states that "if E-SAT were to reduce the maximum number of concurrent users to 40 there would be a reduction of 1.53 dB in RFI at the Orbcomm satellite. If E-SAT is using 20 concurrent users there is a reduction of 3.03 dB at Orbcomm's satellite." Here again E-SAT's analysis is flawed. The total noise floor increases directly as the sum of the number of interfering signal powers. Thus, a reduction from 81 users to 40 users decreases the interference power by 3 dB on the average. However, Leo One USA's analysis indicates that even 10 concurrent users results in significant degradation to Leo One USA even under the assumption that E-SAT will operate cross-polarized to Leo One USA.

- *Solution 5 - Polarization Diversity:* E-SAT has indicated it could operate on its uplink in an opposite polarization sense from Orbcomm's uplink. E-SAT implies it could achieve 20 dB of discrimination using this approach and safely 17 dB or more. E-SAT fails to state what axial ratio its meter readout antennas can achieve over their field of view, nor does it indicate what Orbcomm's axial ratio would be. Based on numerical EM modeling, Leo One USA believes that when spacecraft body interactions are taken into consideration, Leo One USA's axial ratio will be no better than 3 dB over the beam. Leo One USA would, likewise, be surprised if E-SAT's omni terminals, when local terrain interactions are considered, are any better than a 3 dB axial ratio. A 3 dB to 3 dB axial ratio with an average 45^0 coupling angle provides only 12.4 dB polarization discrimination, which is a better estimate. This is generally consistent with 13 dB assumed by the ITU when performing similar calculations[3].

As this analysis indicates, the sharing proposals made by E-SAT are problematic. They do not provide an acceptable basis that will allow CDMA and FDMA systems to share the 148.905 - 149.9 MHz band. To date, E-SAT has not provided any detailed technical information that will allow a full evaluation of possible sharing arrangements. If E-SAT provides such information, Leo

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[3] Methodology For Evaluating Interference From Narrow-Band Mobile-Satellite Networks To Spread-Spectrum Direct-Sequence Mobile-Satellite Networks Operating With Space Stations In Low-Earth Orbit At Frequencies Below 1 GHz", ITU Doc. 8D/TEMP/72 (Rev. 1)-E, 7 Nov. 1996.

One USA is prepared to work with E-SAT to determine if there is an acceptable solution to this problem.

If you have any further questions regarding this matter, please do not hesitate to contact the undersigned.

Very truly yours,

Robert A. Mazer
Albert Shuldiner
Counsel for Leo One USA Corporation

cc: Parties of Record